March 20, 1956 D. B. PERLIS 2,738,856

MEANS FOR STABILIZING A MOVING BODY

Filed Oct. 4, 1952

Fig. 1.

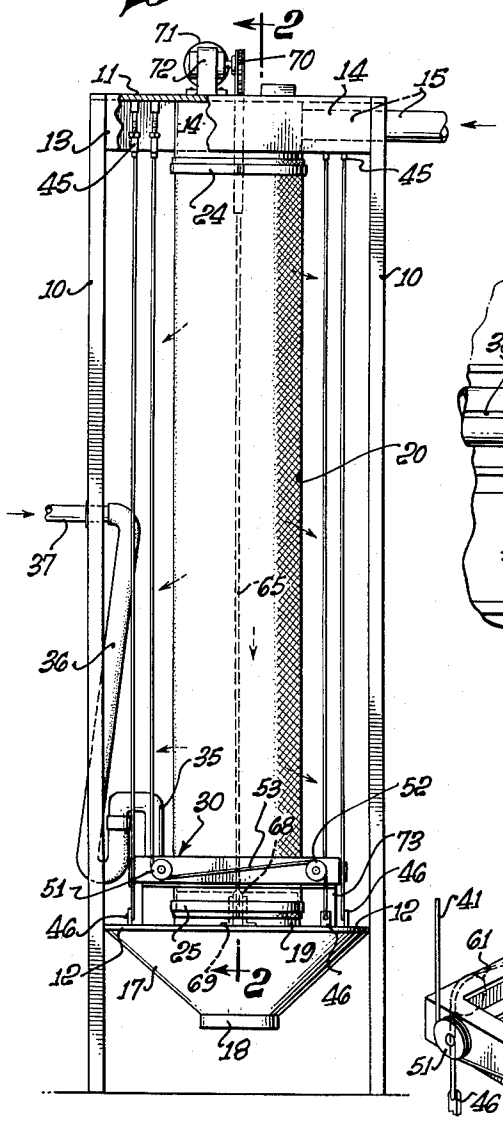


Fig. 2.

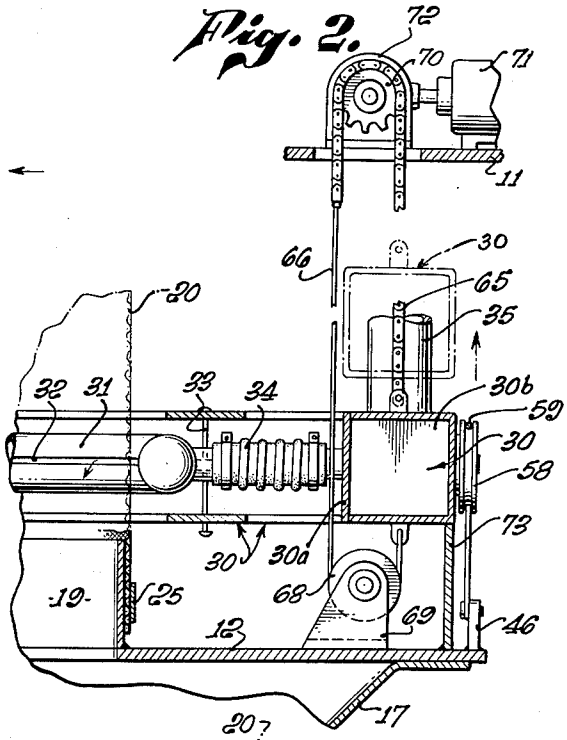


Fig. 3.

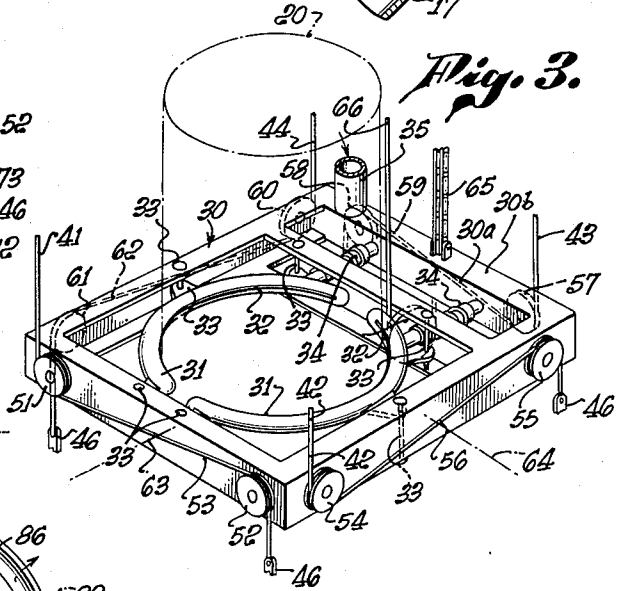
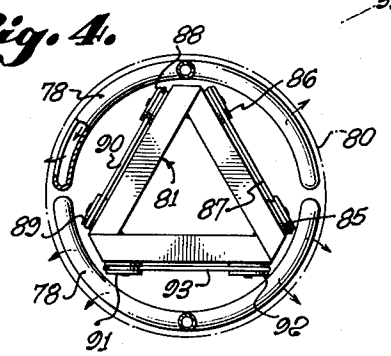


Fig. 4.



DAVID B. PERLIS,
INVENTOR.

BY Knight & Rodgers

ATTORNEYS.

United States Patent Office 2,738,856 Patented Mar. 20, 1956

2,738,856

MEANS FOR STABILIZING A MOVING BODY

David B. Perlis, North Hollywood, Calif., assignor to Western Precipitation Corporation, Los Angeles, Calif., a corporation of California

Application October 4, 1952, Serial No. 313,112

5 Claims. (Cl. 183—61)

This invention relates generally to mechanical movements wherein a body, such as a carriage, moves along a predetermined rectilinear path and the invention is particularly directed to means for stabilizing or stabilizing and guiding a carriage in a fixed orientation or relative position as it moves along a path. The term stabilizing as used herein means to maintain the carriage at a constant orientation relative to the path, the carriage being held against rotation about any axis extending transversely of the path.

In some instances the invention may be used solely or primarily for stabilization of a carriage along a path in combination with additional means serving to guide the carriage along the path. Thus separate guide means apart from the invention may be provided when the path is non-vertical. A feature of the invention, however, is that it may be used for both stability and guidance, having special utility for this dual purpose when the path of the carriage is vertical or near vertical.

It is common practice to use rails or other rigid means to stabilize and guide a carriage or the like along various paths of movement. A conventional passenger elevator, for example, is guided along a vertical path and at the same time is stabilized or held to a constant orientation relative to that path by rigid rails. A primary object of the present invention is to provide the same kind of stabilization by an arrangement of flexible means such as rope or cable instead of the usual rigid members.

A further object of the invention is to provide an efficient stabilizing or guiding means for this purpose that is of simple and inexpensive construction. In this regard a feature of the invention is that it comprises a simple arrangement of a few low-cost cables and pulleys that may be readily assembled. A further feature is that the individual cables and pulleys may be quickly and easily replaced at low cost when necessary.

Another object of the invention is to provide means for stabilizing or guiding a carriage or the like that requires space of minimum dimension in the direction of the path of the carriage. This object may be understood by considering the manner in which a carriage or the like is stabilized by engaging at vertically spaced points a conventional rigid guide means such as a vertical rail. For the purpose of the present explanation, the vertically spaced points of moving engagement with said guide rails may be regarded as defining a vertical stabilization base serving to maintain the vertical orientation of the elevator car. In general, the greater the dimension or the length of such a stabilization base the greater the degree of stability provided by the base.

In many instances, however, the requirement for a comparatively long stabilization base conflicts with the desirability for a maximum range of reciprocation of the carriage within a given available space. For example, if a space ten feet high is available for the vertical reciprocation of a carriage 6" thick in vertical dimension it would be possible for the carriage to reciprocate over a vertical path 9½ feet long if only the dimensions of the

carriage need be considered. If, however, it is necessary to provide an 18 inch vertical stabilization base in the engagement of the carriage with vertical guide means the maximum range of reciprocation is reduced to 8½ feet or less.

An important feature of the invention in this respect is the provision, in effect, of a stabilization base that lies transversely of the direction of carriage travel. Such a transversely position stabilization base requires but little space in the direction of travel but may nevertheless be relatively long to provide a high degree of stability. In the above example, the transverse stabilization base may lie wholly within the limits of the 6 inch vertical dimension of the carriage and thus permit the maximum 9½ foot range of reciprocation of the carriage within the given 10 foot space. A further feature of the invention is that the reaction of stabilization forces on the flexible guide means is against the tension of the guide means so that a system of flexible cables in tension may hold a traveling carriage at a desired orientation to its path of travel.

In general, these broad objects of the invention are attained by using a plurality of flexible members, typically cables, anchored at opposite ends of the range of travel of the carriage and having terminal portions that extend parallel to the path of travel but with intermediate portions of the cables offset laterally by passing over a pair of pulleys or the like on the carriage. The offset portions of the cables provide the transverse equalization bases. The pulleys define changes in direction of the cables to provide the required offsets and rotate to permit free movement of the carriage along the path.

Since the tensioned cables tend to straighten out, each of the offset cable portions reacts on the corresponding pulleys to create a moment tending to rotate the carriage out of orientation, but the arrangement is such that one moment is in opposition to another with all of the moments in balance or equilibrium at the desired orientation of the carriage. Thus the cables as a group act in tension to stabilize the carriage at the desired orientation and at the same time hold or guide the carriage on the desired path of travel. While the invention is broadly applicable for its basic purpose in various fields, it is herein shown and described as embodied in a filter for the purpose of reciprocating a jet ring along an upright cylindrical filter medium. The function of the gaseous jet issuing from the ring is to dislodge solid particles deposited on the filter medium by a particle-laden gas stream passed through the filter to be cleaned. This embodiment of the invention will be described herein for the purpose of disclosure and illustration of the invention but without necessary limitation thereto.

In a filter of this type, the cleaning jet is provided by an annular nozzle that directs a stream of cleaning gas counter to the direction of the particle laden gas stream. The jet may be directed inwardly from an external jet ring surrounding the cylindrical filter medium or may be directed radially outward from a jet ring inside the filter medium, depending upon whether the particle-laden gaseous stream flows radially outward or radially inward respectively.

It is desired to maintain the jet ring in a given orientation as the jet ring reciprocates along the length of the filter medium. Proper orientation is desired in order to avoid undue wear on the filter medium, loss of air between the ring and the filter medium, and other harmful results of improper or changing orientation.

The various objects, features, and advantages of the invention will be apparent from reference to the following detailed description together with the accompanying drawing, in which:

Fig. 1 is a side elevation of a typical reverse jet filter construction incorporating the presently preferred em-

bodiment of the invention for stabilizing and guiding the jet-ring carriage;

Fig. 2 is a fragmentary vertical section on a larger scale taken as indicated by the broken line 2—2 of Fig. 1;

Fig. 3 is an enlarged perspective view of the jet-ring and its carriage removed from the filter, showing the associated elements of the improved stabilizing means;

Fig. 4 is a plan view of another embodiment of the invention showing a jet-ring carriage adapted for reciprocation inside of a vertical filter bag.

The particular apparatus shown in Figs. 1 to 3 includes four vertical frame members **10** which also serve as legs and which are interconnected by top plate **11** and bottom plate **12**. Side plates **13** are connected to the top plate and the four legs **10** to brace the frame. A cylindrical collar or thimble **14** is fastened to the underside of plate **11** so that the plate closes the upper end of the thimble. At one side the thimble is connected to inlet duct **15** to receive, for example, a dust-laden air stream that is to be filtered.

Fastened to the underside of bottom plate **12** is hopper **17** which is closed at the upper end by plate **12** and is provided at its lower end with dust outlet **18**. Plate **12** has a central opening (not shown) around which is located another collar or thimble **19** which is cylindrical in cross-section and vertically aligned with upper thimble **14**. A suitable cylindrical filter medium **20** interconnects the two thimbles **14** and **19**, being secured around upper thimble **14** by a suitable split band fastening means **24** and being secured around lower thimble **19** by a similar split band fastening means **25**. The filter bag **20** may be made of any suitable porous fabric or material.

The dust-laden stream of gas or air that enters the apparatus through duct **15** passes downward into the space inside filter medium **20** and then escapes by passing radially outward through the interstices of the filter medium. The dust entrained in the air is collected by the filter medium, most of the dust particles being lodged on the fibers of the bag filter medium. A suitable reverse jet means (described below) in the form of a jet ring reciprocates along the length of the bag to direct a traveling jet of cleaning air or gas inwardly through the filter medium to dislodge particles from the filter medium which then fall into the hopper **17**.

In the construction shown in the drawing there is provided a carriage **30** in the form of a horizontal rectangular frame that carries the jet or cleaning ring, here in the form of two half-circle segments **31**, each of which has an inwardly directed, elongated orifice **32** (see Fig. 3). The ring is made in two segments to obtain adjustability of the ring relative to the filter medium; and being non-rigid itself, it is mounted on a rigid carriage which is properly oriented to orient, in turn, the ring throughout its travel. Carriage **30** is conveniently made from four lengths of structural channel welded together at their ends to provide a rigid carriage. Although other designs may be used, it is preferred to weld a plate **30***a* across the legs of the channel at one side of the frame to form an air-tight box **30***b* that serves as a header for the supply of cleaning air.

Each ring segment **31** is non-rigidly supported from the carriage by any suitable means, the means here shown being a plurality of short cables **33**, one of which is shown in Fig. 2. Each cable **33** is loosely secured in a suitable way at or near each end to frame **30** and at or near its midpoint to a segment **31**. This allows the cleaning ring to move a limited amount relative to the frame as the latter travels up and down. Each segment **31** is connected by a short section of flexible hose **34** to header **30***a* in the carriage structure (Fig. 2). The header in turn communicates with a suitable fitting such as a goose-neck **35**. The goose-neck fitting **35** is connected by a suitable flexible hose **36** to a fixed supply pipe **37** for compressed air. Pipe **37** is horizontally offset from goose-neck **35**; and this, combined with a sufficient length of hose **36** makes an arrangement such that flexible hose **36** permits full range of up and down movement of the carriage.

The stabilizing and guiding means for carriage **30** in the present form of the invention includes four cables individually designated **41**, **42**, **43**, and **44** each of which is anchored at its upper end to the under side of top plate **11** by a suitable turnbuckle **45** and is anchored at its lower end to top plate **12** of the hopper by a second anchor means **46**. It is preferable to provide means for adjusting each of the four cables in tension individually and for this purpose each cable may be provided with a turnbuckle **45** or similar tension adjusting means.

Each of the four cables **41**–**44** engages a pair of guide members, typically pulleys or other anti-friction means, mounted on one of the four sides of carriage **30** to form a corresponding lateral offset in the cable that creates a pair of moments or a couple acting on carriage **30**. Four similar offsets are formed in the following manner: Cable **41** passes under pulley **51** and over pulley **52** to form a lateral cable offset at **53**; cable **42** passes under pulley **54** and over pulley **55** to form a lateral cable offset at **56**; cable **43** passes under pulley **57** and over pulley **58** to form a lateral cable offset at **59**; and cable **44** passes under pulley **60** and over pulley **61** to form a lateral cable offset at **62**.

The two pulleys of each pair, e. g. pulleys **51** and **52**, are located on one side of the polygon formed by frame **30**, and are spaced apart horizontally or transversely to the path of carriage travel, which is here a vertical path. The pulleys of this pair, together with the associated cable, lie in a vertical plane which intersects both plates **11** and **12**. The axes of all pulleys are horizontal and preferably, though not necessarily, located in a single horizontal plane, normal to the direction of their travel.

This condition permits a minimum height for carriage **30**. The pulleys are preferably near the corners of the frame so that the two pulleys of a pair mounted on one side of the frame are spaced as far apart as practical for a carriage of given dimensions. Since this inter-pulley spacing establishes the stabilization base referred to above, it is obviously advantageous to make the base as long as practical; but above a satisfactory minimum degree of stability, it may not be particularly advantageous to increase the spacing between pulleys of a pair.

Weaving each cable under and over a pair of pulleys as described produces a configuration of the cable such that each cable has an upper run between the carriage and top plate **11**, the length of which run varies as the carriage travels, and a lower run, likewise variable in length, between the carriage and bottom plate **12**. Between and interconnecting the upper and lower terminal runs of each cable is an intermediate run or lateral offset as just described. The upper and lower runs of each cable are parallel to each other, but laterally offset from each other, and are parallel to all other upper and lower runs in order to define the path traveled by the carriage.

As can be seen in Fig. 3 the two cables at opposite sides of the carriage **30**, e. g. cables **41** and **43**, because of their offsets tend to rotate the carriage in opposite directions about a horizontal axis **63** intersecting the mid-points of the two cable offsets **53** and **59**; and in like manner, the two cables **42** and **44** because of offsets **56** and **62** oppose each other with respect to the turning moments they exert on the carriage about an axis **64** through the mid-points of offsets **56** and **62**. Each turning moment created by the four cables is balanced by an equal and opposite moment, and the carriage is in equilibrium about two horizontal axes **63** and **64** normal to each other and transverse to the direction of carriage travel. Considering all eight vertical runs, they are symmetrically disposed about each of axes **63** and **64** and the forces they produce are directed in a manner to balance each other about either or both of these two axes.

It will be noted that at each corner of the frame one

of the cables extends vertically downward to its anchorage point and the adjacent cable extends vertically upward to its anchorage point. Thus the vertical runs of two different cables adjacent each corner of the carriage are balanced in tension to hold and guide the carriage against tilting about a horizontal axis.

It is a simple matter to adjust the four turnbuckles **45** for proper tensioning of the four cables to maintain the carriage **30** in the desired horizontal or other orientation as it traverses the filter bag **20**. Since shortening or lengthening a cable has a turning effect on the carriage, it is a simple matter to level or otherwise position the carriage with close accuracy.

A feature of the invention is that the described stabilizing and guiding means is so effective that the carriage **30** may be readily reciprocated by a force applied at only one point on the carriage. In the particular arrangement shown sprocket chain **65** is connected to one side of the carriage at the upper face and extends upwardly and over drive sprocket **70**. Sprocket **70** is driven by motor **71** which is of the reversible type and is provided with a speed reducing head **72** having an output shaft on which sprocket **70** is mounted. The other end of chain **65** is connected to cable **66** that extends downwardly and under idler pulley **68**. This pulley is rotatably mounted on bracket **69** which is fastened to plate **12**. After passing around pulley **68**, the other end of the cable is attached to the under face of the carriage at a point directly below the attachment of sprocket chain **65**. In a conventional manner suitable limit switches (not shown) may be provided on chain **65** or cable **66** to cause reversal of the motor as carriage **30** reaches the upper and lower limits of its range of reciprocation. Preferably an angular guard frame **72** around idler pulley **68** is mounted on the top of plate **12**, which frame may serve as a rest for the carriage when the device is shut down for servicing or repairs.

In the second form of the invention shown in Fig. 4, a cleaning ring comprising two half-circle segments **78** is mounted inside a cylindrical filter **80** to direct reverse air jets outwardly through the surrounding filter medium as indicated by the arrows. The segments **78** are carried by a carriage **81** comprising a triangular frame that is dimensioned to lie inside the circumference defined by the cleaning ring.

In this second embodiment of the invention only three cables are employed, one at each of the three sides of a triangular carriage frame. One cable passes under a pulley **85** and over a pulley **86** to form a cable offset **87**; a second cable passes under a pulley **88** and over a pulley **89** to form a cable offset **90**; and a third cable passes under a pulley **91** and over a pulley **92** to form a cable offset **93**. Though not shown in the drawings, each cable has an upper run and a lower run parallel to each other and to the other cable runs exactly as described before. The upward pull of each upper run is counterbalanced by the downward pull of a lower run adjacent the same corner of the frame, so that the frame is stabilized at three points, which is sufficient to establish a horizontal plane for the carriage.

Assume an axis in the plane of Fig. 4 normal to and intersecting the mid-point of cable run **93**. The turning moments applied at pulleys **91** and **92** tending to rotate the frame about this axis are equal and opposite and so balance each other. The same is true if all six vertical runs are considered as they are symmetrically disposed about this axis to balance each other. This same situation prevails about each of two other axes that are normal to and bisect the other two lateral cable runs **87** and **90**. Hence, it is apparent that the moments acting on the carriage are in equilibrium and maintain the carriage **81** in a given horizontal orientation as the cables guide the carriage along its path.

From the foregoing it is evident that the invention may be applied to a polygonal carriage having three

or four or more sides. But it is also to be understood that, in a broader sense, it is not necessary that the carriage have such physically defined sides, since the pulleys can be mounted on the carriage in a manner to produce the desired end result regardless of the configuration of the carriage. Thus it is sufficient to practice the invention to mount the pulleys in pairs so that there are three or more offsets in as many cables arranged around the body with the cables at adjacent ends of the offsets extending in opposite directions parallel to the path and balancing the moments about two or more axes extending transversely to the direction of travel.

A carriage can be stabilized, guided and supported by cables in this manner for movement along a vertical path, or one that is generally so, if the carriage is not necessarily confined to a precise path; but where the invention is employed to move a carriage along a horizontal or inclined path it will usually be desirable to provide additional rigid means to support the weight of the carriage such as one or more rails or the like extending parallel to the path. The cables then serve only to maintain the carriage in a fixed orientation relative to the path.

An outstanding advantage is the fact that it is necessary merely to maintain the cables under proper tension to avoid all looseness and to compensate for wear on the cables, the pulleys and the pulley bearings. It is also to be noted that the invention does not involve any synchronization problem in the stabilization and guidance of a carriage.

My description in detail of the presently preferred practices of the invention may suggest to those skilled in the art various changes, substitutions and other departures from disclosure that properly lie within the spirit and scope of the appended claims.

I claim:

1. Means to stabilize a body movable along a linear path at a given orientation relative to the path comprising: a plurality of elongated flexible members having terminal sections extending in tension parallel to said path, the two terminal sections of each flexible member lying in a common plane parallel to the path; and a plurality of sets of guide members mounted on the body and engaging the flexible members, the guide members of each set being spaced apart in said plane transversely of said path and engaging one flexible member to produce a lateral offset therein; there being a plurality in excess of two of such flexible members defining an equal plurality of said planes which completely surround the path of the body with each plane intersecting two other planes, the guide members being so located on the body as to produce in each of said planes a plurality of forces each individually directed parallel to the path, each force being counteracted by an equal and opposite force in an intersecting plane whereby all forces are in collective equilibrium about two mutually perpendicular axes and the orientation of the body is maintained by said forces.

2. Means for stabilizing a body movable along a rectilinear path to prevent rotation of the body about axes transverse to the path, comprising: two anchor means spaced apart in the direction of said path; a plurality in excess of two of pairs of pulleys mounted on the body in a corresponding number of planes parallel to the path, the pulleys of each pair being spaced apart transversely of the body and each plane established by a pair of pulleys intersecting two other planes; and a corresponding plurality of elongated flexible tension members anchored at their opposite ends to the anchor means, each of said planes containing only one flexible member having terminal sections extending from one anchor means parallel to said path to one pulley of a pair and an intermediate section extending between the pulleys of a pair, the tension in each terminal section being counterbalanced by tension in an oppositely directed terminal

section of another flexible member lying in an intersecting plane.

3. In a filter for cleaning a particle laden gas stream and having a tubular filter medium with its longitudinal axis disposed substantially vertical providing a surface upon which particles carried by the gas stream may accumulate, the combination of: cleaning means substantially embracing the filter medium and movable relative thereto parallel to said axis of the filter medium; a carriage of substantially polygonal configuration upon which the cleaning means is mounted; means for imparting movement to the carriage; and means for guiding and stabilizing said carriage during its movement in a substantially linear path parallel to said axis, including anchor means at two different positions spaced apart in the direction of said path, only one pair of guide members mounted in a common plane on the carriage at each of at least three sides thereof, said planes forming a closed figure about the filter medium, the members of each pair of guide members being horizontally spaced apart along the side of the carriage, and a single cable at each side of the carriage upon which a pair of guide members is located, each cable having its ends attached

respectively to said anchor means and extending from one said anchor means beneath and in engagement with one guide member, thence over and in engagement with the other guide member of a pair to produce a lateral offset in the cable, and thence to the other anchor means, the cables at adjacent ends of successive offsets extending in opposite directions away from the carriage and parallel to said path.

4. The combination as in claim 3 in which the carriage is rectangular and the cables are arranged one in each of four planes at the respective sides of the carriage.

5. The combination as in claim 3 in which the carriage is triangular and the cables are arranged one in each of three planes at the respective sides of the carriage.

References Cited in the file of this patent

UNITED STATES PATENTS

2,551,126	Hersey	May 1, 1951
2,552,191	Lang	May 8, 1951
2,594,957	Martens	Apr. 29, 1952